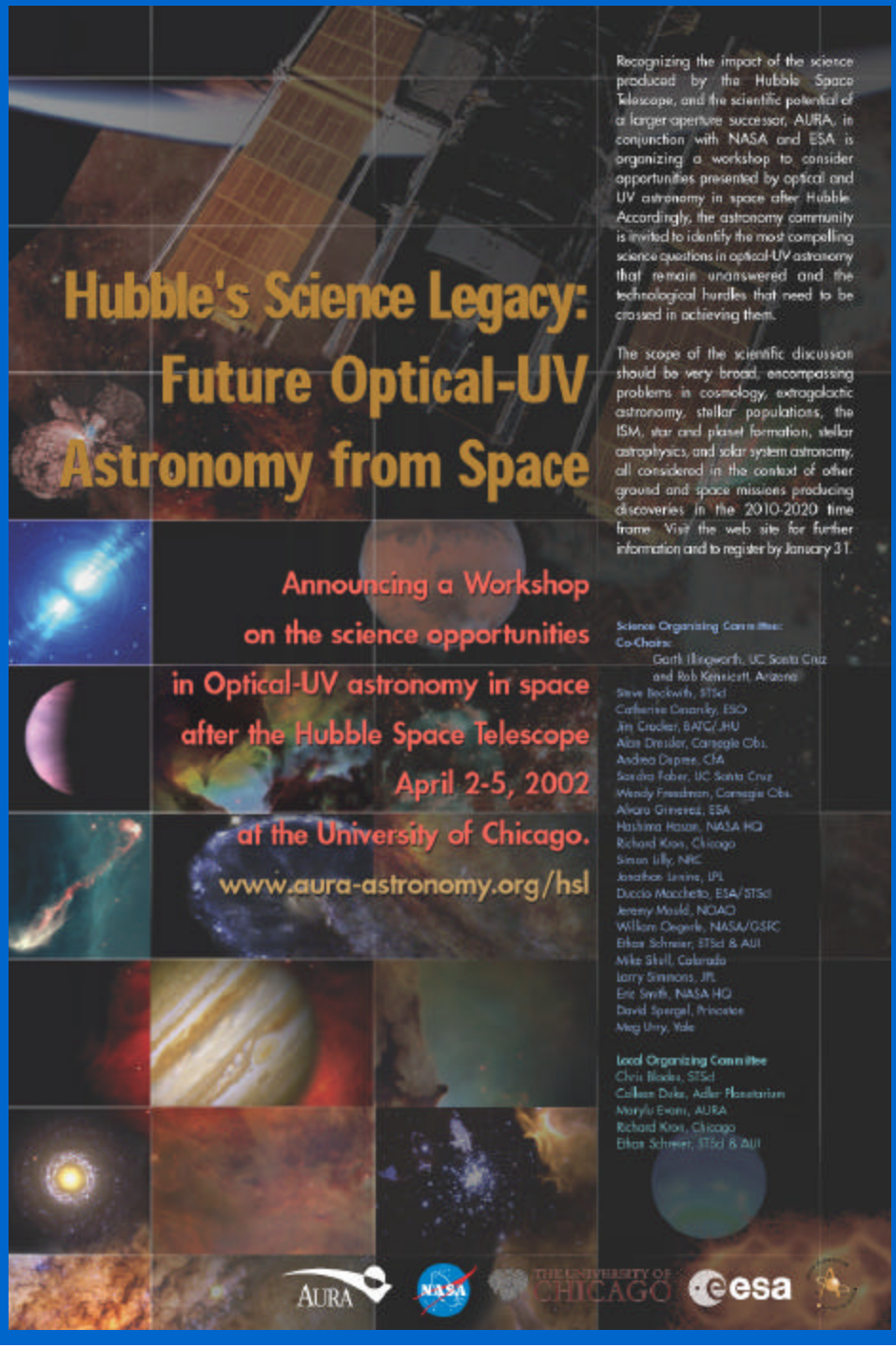
HSL Workshop

April 2-5, 2002
University of Chicago

AURA/NASA/ESA

G. Illingworth
R. Kennicutt
Co-Chairs

www.aura-astronomy.org/hsl



Context

- HST de-orbit in ~2010 will leave astronomy without high-resolution capability in visible-UV (0.1 - 1 ?m)
- SUVO initiative proposed modest-aperture successor to AASC --> not recommended
  - modest planning effort continuing via SEU
- Need for a broader assessment of future science opportunities and feasibility of a large HST successor facility, for 2010-2020 time frame
- Initial focus on large (~8m) telescope with a large discovery potential
  - sensitivity 20-100x HST
  - angular resolution of order 10 milliarcsec over large fields
  - possible coronagraphic and/or adaptive capabilities
  - can assess merits vs smaller single/multiple missions

Workshop Objectives

- Identify likely key science problems in 2010-2020 time frames: solar system --> cosmology
- Assess scientific need for post-HST space facility (diffraction-limited performance in visible- UV)
  - core science drivers
  - key science, important for defining technical capabilities
- Identify likely technological capabilities, key technical challenges for large visible-UV telescopes
  - critical assessment in light of 30m telescopes + AO, precursor space facilities
  - identify key areas for early or long-term technology investment, to enable facilities in 2010+

Workshop Products

- Published proceedings (~50 invited talks + posters)
- White paper
  - distillation of principle outcomes of workshop
  - SOC (below) provided preliminary ideas based on workshop planning discussions
- SOC
  - G Illingworth, R Kennicutt, S Beckwith, C Cesarsky, J Crocker, A Dressler, A Dupree, S Faber, W Freedman, A Gimenez, H Hasan, R Kron, S Lilly, J Lunine, D Macchetto, J Mould, W Oegerle, E Schrier, M Shull, L Simmons, E Smith, D Spergel, M Urry

(Anticipated) Science Drivers

- Exoplanetary systems
  - direct imaging of solar systems, earth-like planets
  - microlensing + transit observations of exoplanetary systems
- High-resolution imaging/spectra of distant galaxies
  - trace rest-UV, star formation without dimming bias
  - detailed dynamics, buildup of dark matter, stars, metals, central black holes
- Evolution of the IGM and galaxy halos
  - thousands of sightlines (through galaxies!) at all redshifts
  - detailed history of IGM structure, ionization, metal evolution
  - galaxy mass loss, superwinds, interaction with IGM
- Precision studies of weak lensing, map dark matter

Science Drivers II

- The Galactic neighborhood
  - precision distances to >30 Mpc: a 3D map of the local universe
  - star formation histories of galaxies vs type, mass
  - definitive age scale, IMF determinations
- High-resolution imaging/spectra of AGNs
- Stellar astrophysics
  - surface imaging of stars, circumstellar structures, SNRs
  - stellar seismology of stars throughout the Galaxy
  - high-resolution studies of proto-planetary disks, jets
- Solar system
  - monitoring of planet weather, geological activity

Technology: Optics

- Lightweighted optics with exquisite accuracy
- Fabrication technologies
- Active wavefront control (primary optics)
- High-reflectivity, durable coatings for visible - UV
- Coronagraphic optimization
- Adaptive optics for high-order wavefront correction
- Thermal control design, testing, demonstration
- Pointing/control systems for 10 milliarcsec imaging

Technology II

- System design studies (e.g., weight, baffling)
- Orbit trade studies
- Detectors
  - high efficiency, dynamic range in UV
  - large formats, mosaics
  - photometric stability, high radiation environment performance
  - new technology, e.g., energy-resolving detectors
- Multi-mirror/shutter arrays
- Contamination control
- Launch vehicle, shroud constrains in 2015 time frame
- Options for on-orbit construction, assembly